Effects of Wrapping Vacuum Chambers For Bake Outs

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Introduction

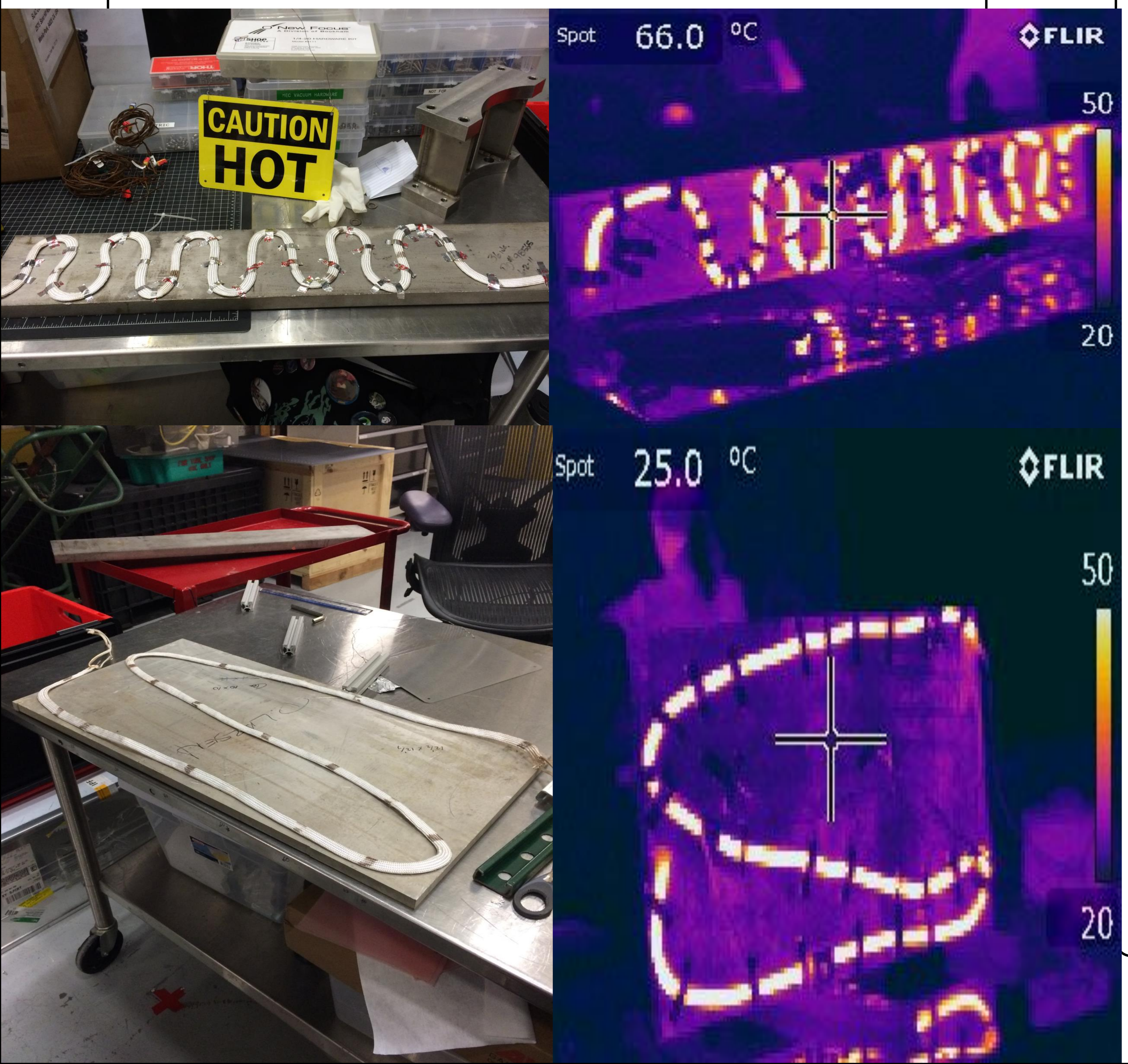
Vacuum chambers are often "baked out" to ensure that when they are being used to achieve a high vacuum, that they are not giving off water vapor or other gases, thus greatly slowing down the process of attaining the required level of vacuum. This is solved by heating the parts until this is all expelled, thus making the parts ready to be used in a vacuum. Most chambers are made of stainless steel, or aluminum, which both conduct heat differently. Most chambers while being baked are wrapped in aluminum, though it is not certain what the effects of the wrap are.

Keywords: Bake out, Heat Conduction, Aluminum, Stainless Steel,

Research

The purpose of this experiment was to test the effects of wrapping a vacuum chamber when baking it. This was done with the same material as that of most vacuum chambers: Aluminum and Stainless Steel. These materials were heated while wrapped, and while unwrapped, and the end temperatures of the "inside of the chamber" was recorded. This was done using heating tape, which was monitored using thermocouples to track the temperature of both the metal and the heating tape. As the metal was heated it's temperature was monitored until it's reached an equilibrium. At this point the temperature was recorded with an infrared camera so the temperature all across the metal can be seen and compared

Fig: Steel and Aluminum Infrared vs. Regular



Below the top picture is the Stainless Steel without the wrap and below that is the image of Stainless Steel with the foil wrap covering the other side. The addition of the foil warp appears to increase the overall temperature of the metal being heated.

Fig E: Steel with no wrap

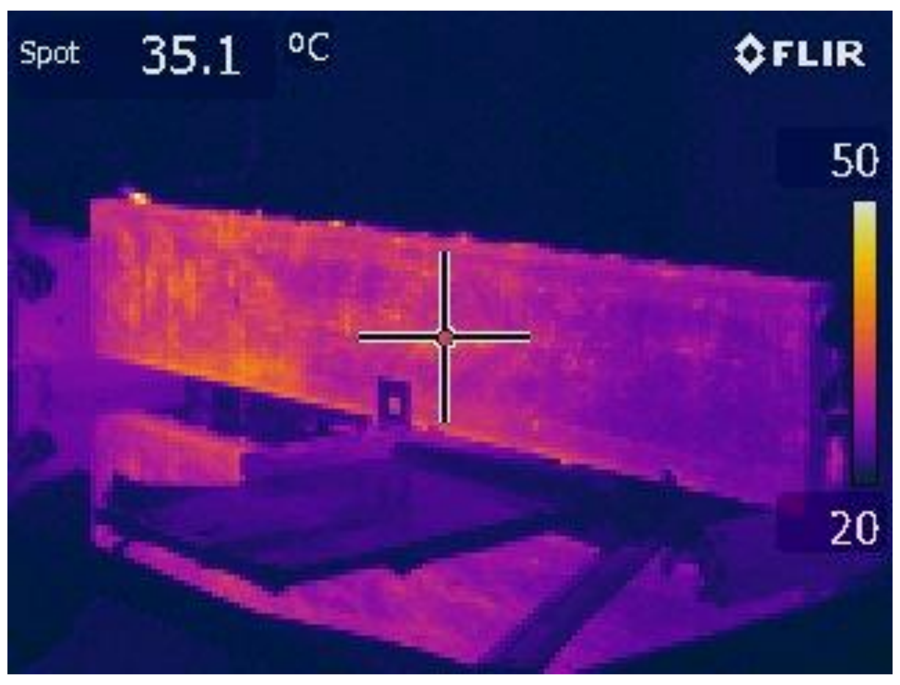


Fig F: Steel with wrap

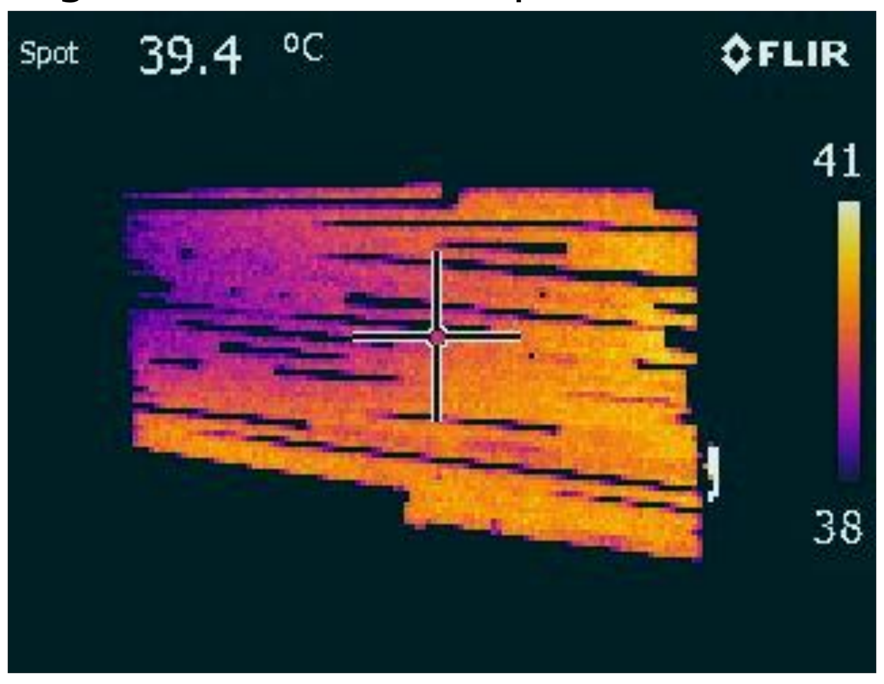


Fig G:Aluminum without wrap

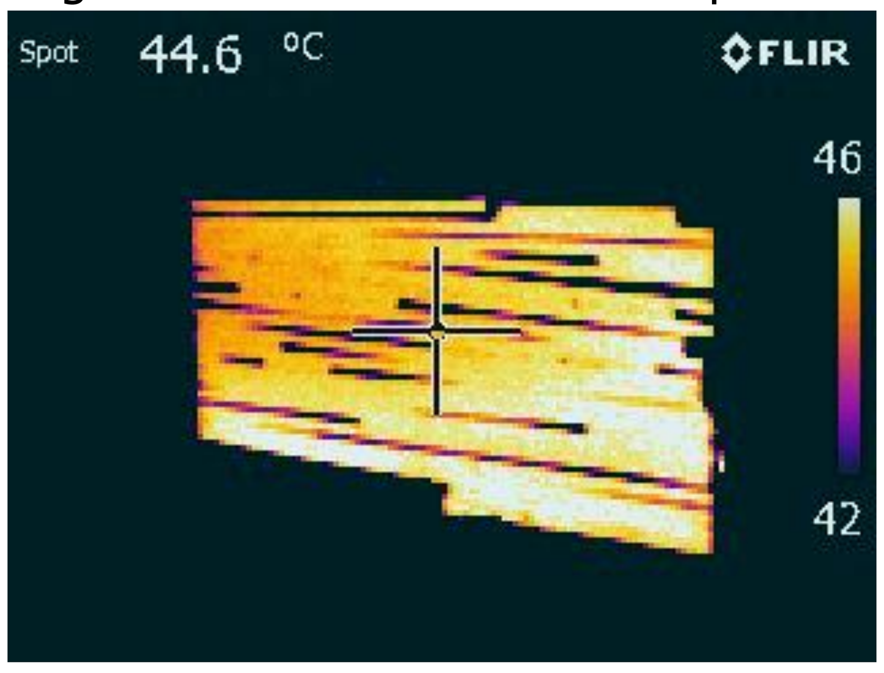
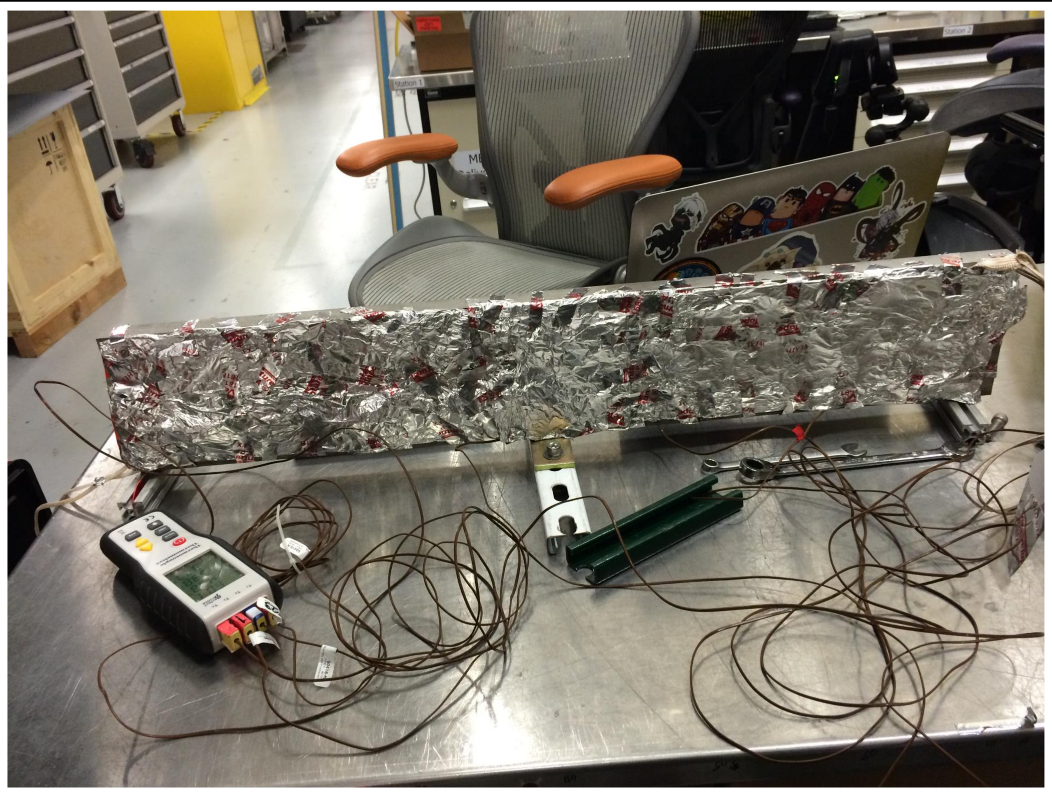


Fig H: Aluminum with wrap

In the prior section you can see the Aluminum without the wrap and below that is the image of Aluminum with the foil wrap covering the other side. Again, the addition of the foil wrap appears to increase the overall temperature of the metal being heated. Aluminum reflected the heat of things around it, making it hard to track. This was solved with the addition of tape to the face of the metal, which explains the bar like appearance.



Stainless Steel wrapped and ready to be heated.

Conclusions

The Aluminum heats much more evenly than the stainless steel, even over a larger piece of metal with heating tape spaced further apart. The Stainless Steel warmed several degrees more with the addition of the Foil wrap on its' front, as can be seen with picture C(with wrap) when compared to D(without wrap). Aluminum also heated more quickly and to a higher temperature with the wrapping the n it did without it. The act of wrapping a chamber while baking it does appear to have an effect on how quickly it heats up as well as how hot it becomes

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